Working with SMDs

It's just a matter of practice

By K. Walraven

Although surface-mounted devices (SMDs) have been a fact of life for a while already, even in DIY electronics, many hobbyists are still reluctant to use them. A few good tips and a bit of practice should help overcome any initial inhibitions.

SMDs, with their minuscule dimensions and absence of pins, are still not particularly popular with DIY constructors. It must be admitted that they are considerably more difficult to work with than conventional components. On the other hand, they have the unique advantage that they allow extremely compact circuits to be built. And as for soldering SMDs — let's just say that it's like a lot of other things: once you've done it a few times, you'll find that it's not all that bad. Try practising with a few spare components after you have read this article. You will see that it's not as difficult as you first thought.

Tools

What do you need? A small soldering of course, or one that you have adapted for the purpose with a piece of copper wire, as shown in **Figure 1**. In addition, you will need a small tweezers, fine wire solder with a resin core and possibly solder paste — and naturally you should not overlook desoldering braid (see the article in the April issue). A steady hand, good light and good eyes are also just as indispensable. If necessary, you can help your eyes with a loupe or an inexpensive pair of reading glasses. A magnifying light can also be quite handy.

The circuit board

In commercial production, soldering paste is applied to the solder pads, and a bit of glue is often applied to the space between the pads. A machine then places the SMD components, which are held in place by the soldering paste and the glue. The entire circuit board is next prewarmed and then passed through an oven for a few seconds for soldering. The solder particles in the paste melt and join the contact surfaces of the components to the copper of the circuit board tracks. Capillary attraction causes the solder to nicely fill all the little gaps. The solder pads on the board are usually just about as large as the contact surfaces of the corresponding components (see **Figure 2**). This helps to hold the components properly in place, even when no glue is used.

However, for hand soldering it's better to have the pads somewhat larger, in order to provide a place to touch the tip of the soldering iron (see **Figure 3**). This is why the solder pads on the circuit boards for Elektor projects are intentionally made larger than usual, to the extent that this is possible.

Soldering

Components with only a few contacts, such as resistors, capacitors and transistors, are the easiest to solder. Work as follows:

- First tin the solder pads — not too much, but also not too little.
- Grasp the component with the tweezers and hold it in the proper position on the circuit board.
- Heat one of the connections with the soldering iron until the solder melts and flows. It does not matter if the joint is not pretty, since that can be fixed later on. All that is intended is to secure the component.
- Check that the component is properly positioned.
- Take the soldering iron in one hand a length of solder in the other hand, and then solder the other contact(s) of the component.
- If the first joint is not good, remove as much solder as possible with the desoldering braid, and then resolder the joint.

It's even easier to work with SMDs if you use solder paste. This is not limited to industrial use, since you can also obtain it in a sort of syringe dispenser for personal use (see the photo of the tools). This is actually solder in the form of a viscous paste, which has the advantage that it tends to hold the components in place. If you use solder paste, work as follows:

- Tin the pads with as little solder as possible (remove any extra solder using desoldering braid), and then apply solder paste to each of the pads.

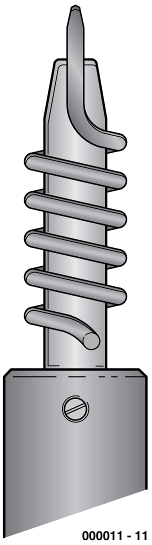


Figure 1. A soldering iron tip adapted for working with SMD components. First wind a few turns of copper wire (1.5 mm or 2.5 mm diameter) around the tip, then heat the iron and solder the wire to the tip. This optimises the heat transfer. You can now solder with the fine tip of the wire.

- Grasp the component with the tweezers and hold it in the proper position.
- Heat one of the leads with the soldering iron until the solder paste melts and flows.
- Check that the component is properly positioned.
- Solder the remaining lead(s) of the component.
- If there is too much solder on any joint, remove the extra solder using desoldering braid. If there is too little solder, touch up the joint using a bit of fresh solder.

Since only a very small mass has to be soldered, it is in practice best to apply the soldering iron and the solder to the surface of the SMD contact to be soldered at nearly the same time. It is not a good idea to first warm up the joint a bit before applying the solder. In fact, the reverse order gives very good results: place the end of the solder against the component and then press the tip of the soldering iron against the solder so that it melts and flows underneath the component. The advantage of this technique is that less flux is lost, which means that the solder wets the surfaces optimally.

Working with ICs

It takes a bit more skill to solder integrated circuits in SMD packages, simply because they have a lot of leads. The leads are frequently placed with a pitch of 1/20 or 1/30 inch, which means that they are very close together. However, in principle you go about soldering an IC in the same way as a component with only two or three leads. Work as follows:

- Carefully tin all the solder pads, and make sure that none of them are shorted together by solder bridges.
- Place the component in position, either by hand or with tweezers.
- Solder two leads on opposite sides of the IC.
- Check that the IC is properly positioned.
- Now solder all the other leads. With very closely spaced leads, it is inevitable that several leads will be connected together by solder bridges (see **Figure 4**), but you can take care of this later. Stop soldering for a little while every so often, to avoid overheating the IC.
- Remove the excess solder from between the leads using desoldering braid. Here again, stop occasionally for a short time to avoid overheating the IC.
- Carefully inspect your work. If necessary,

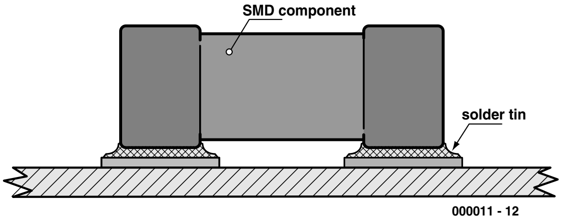


Figure 2. With industrial soldering, the gaps between the contact surfaces of the components and the solder pads are nicely filled with solder.

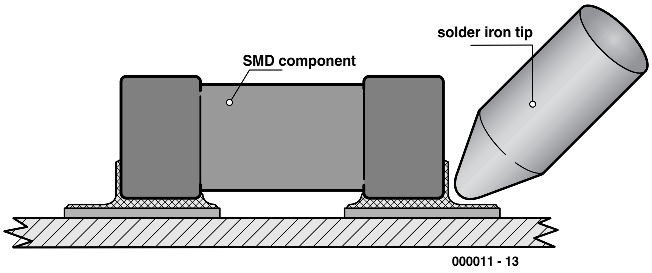


Figure 3. On Elektor circuit boards, the solder pads for SMD components are usually made a bit larger than normal in order to provide a touch surface for the soldering tip.

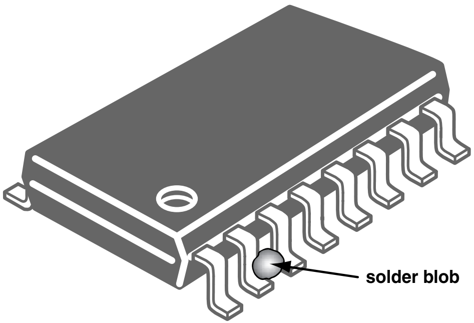
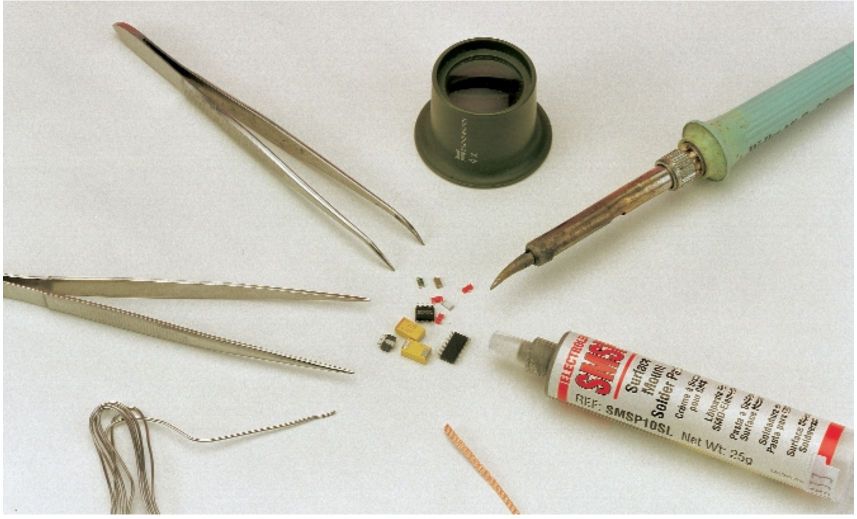


Figure 4. When you solder an IC, it's not uncommon for a solder blob to remain between the leads.



use an ohmmeter to check for unintentional shorts between the leads.

Desoldering

Whenever you have to remove a (possibly defective) SMD IC from a circuit board, the simplest method is usually to cut through each of its leads and then desolder the remaining bits of lead wire one at a time. The IC is of course useless after this, but it is by far the fastest method. You cannot use this technique with resistors and capacitors, since they do not have leads. You may also not wish to destroy the resistor or capacitor. Here you can try the following:

- Remove as much solder as possible using desoldering braid.
- Push a thin piece of wire underneath the component (0.1 to 0.2-mm enamelled copper wire).
- Heat one of the joints and pull the wire out sideways, through the joint.
- With an IC, you can pull the wire out through the joints of several leads at a time.

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